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(54) **A throttle mechanism.**

(57) A throttle mechanism (10) for an engine of a motor vehicle comprising a throttle body (12) having an inner wall (36) defining a bore (38) extending therethrough and an outer wall (40), the bore having a longitudinal axis (X); a shaft (14) extending across the bore and having a longitudinal axis (Y) substantially perpendicular to the longitudinal axis of the bore, the shaft being rotatably mounted in the inner wall of the throttle body for pivotal movement about the longitudinal axis of the shaft, at least one end (42) of the shaft passing through the inner wall to extend beyond the outer wall; a flap valve (16) secured to the shaft inside the bore for movement between a fully open position and a substantially closed position on rotation of the shaft; a lever arm (18) secured to the said at least one end of the shaft adjacent the outer wall; means (20) connected to the outer wall of the throttle body for rotating the shaft; and idle adjust means (30) comprising a cam (146) having an aperture (150) therethrough through which a threaded shank of a screw (140) can freely pass to adjustably secure the cam to the outer wall, the cam having a surface (148) which is engaged by the lever arm at a position spaced from the said at least one end of the shaft, the rotational position of the cam relative to the screw determining the closed position of the flap valve.

Fig.8.

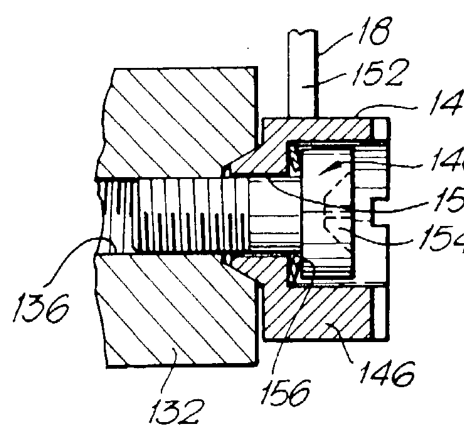

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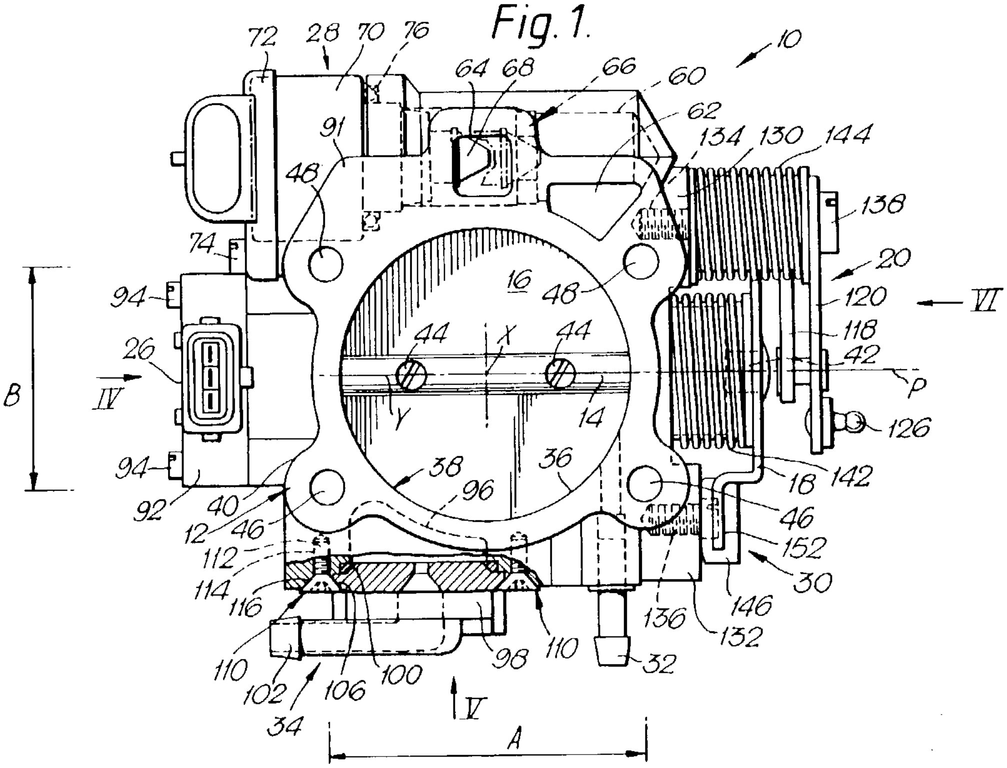
Fig. 1.



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This invention relates to a throttle mechanism for an engine of a motor vehicle.

There are numerous designs of throttle mechanisms for engines which are well known to those skilled in the art. These known throttle mechanisms basically comprise a throttle body with a bore therethrough, a shaft extending across the bore and having a flap valve secured thereto, and means for rotating the shaft relative to the throttle body. Generally, the problem associated with these known designs is that for each design of engine, and/or for each application of the throttle mechanism, a different design of throttle mechanism is required in terms of the layout of the throttle mechanism and/or the layout of the elements attached to, or forming part of, the throttle mechanism.

It is an object of the present invention to overcome one or more of these disadvantages.

To this end, a throttle mechanism in accordance with the present invention comprises a throttle body having an inner wall defining a bore extending therethrough and an outer wall, the bore having a longitudinal axis; a shaft extending across the bore and having a longitudinal axis substantially perpendicular to the longitudinal axis of the bore, the shaft being rotatably mounted in the inner wall of the throttle body for pivotal movement about the longitudinal axis of the shaft, at least one end of the shaft passing through the inner wall to extend beyond the outer wall; a flap valve secured to the shaft inside the bore for movement between a fully open position and a substantially closed position on rotation of the shaft; a lever arm secured to the said at least one end of the shaft adjacent the outer wall; means connected to the outer wall of the throttle body for rotating the shaft; and idle adjust means comprising a cam having an aperture therethrough through which a threaded shank of a screw can freely pass to adjustably secure the cam to the outer wall, the cam having a surface which is engaged by the lever arm at a position spaced from the said at least one end of the shaft, the rotational position of the cam relative to the screw determining the closed position of the flap valve.

This arrangement is such that it provides a simple design of idle adjust means which only requires a threaded bore to be formed in the outer wall of the throttle body, and can therefore be easily positioned at any required location without the need for separate designs of throttle body for each use of the throttle mechanism.

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a plan view of a throttle mechanism in accordance with the present invention;

Figure 2 is an end view of a manifold to which the throttle mechanism of Figure 1 can be attached;

Figure 3 is a plan view of an air horn which is attached to the throttle mechanism of Figure 1;

Figure 4 is a side view in the direction of arrow IV in Figure 1 showing the attachment of the throttle position sensor and the idle air control valve motor but with other features omitted for clarity;

Figure 5 is a side view in the direction of arrow V in Figure 1 showing the fluid heating means and the air horn positioned on the throttle body but with other features omitted for clarity;

Figure 6 is a side view in the direction of arrow VI in Figure 1 showing the throttle linkage and idle adjust means but with other features omitted for clarity;

Figure 7 is a view similar to that of Figure 6 with the positions of the throttle linkage and idle adjust means reversed; and

Figure 8 is a cross-sectional view of the idle adjust means of Figure 1.

Referring to Figure 1, a throttle mechanism 10 in accordance with the present invention is shown, and comprises a throttle body 12, a shaft 14, a flap valve 16 of the flat butterfly type, a lever arm 18 and means for rotating the shaft in the form of a throttle linkage 20. Other forms of rotating means, such as a DC electric motor, cable, cam or simple lever and stud, may be used. The throttle body 12, in use, is secured between a manifold 22 (Figure 2) and an air horn 24 (Figure 3). The manifold 22 is attached to an engine of a motor vehicle, as is well known to those skilled in the art, and an air filter can be mounted on the opposite side of the air horn 24 to the throttle body 12 usually via a separate duct from a remote air filter housing. Alternatively, the duct and the air horn may be formed in one piece, or the air horn may simply be an extension of the air filter housing. Also attached to the throttle body 12 is a throttle position sensor 26, an idle air control valve assembly 28, an idle adjust means 30, a vacuum connection 32, and fluid heating means 34. The above features are described in more detail below.

The throttle body 12 has an inner wall 36 which defines a bore 38 which extends through the throttle body in a longitudinal (height) direction H (Figure 4), and an outer wall 40. The bore 38 has a longitudinal axis X and may have a profile which is straight along its length, or dual spherical, either of which profiles are well known to those skilled in the art. The shaft 14 extends across the bore 38 such that the longitudinal axis Y of the shaft is substantially perpendicular to the longitudinal axis X of the bore. Both ends of the shaft 14 are mounted in the throttle body 12 by way of bearings (not shown)

which allow the shaft to rotate about its longitudinal axis Y relative to the throttle body. One end 42 of the shaft 14 extends beyond the outer wall 40 and is secured to the lever arm 18. The other end of the shaft 14 also extends beyond the outer wall 40 and is associated with the throttle position sensor 26. The flap valve 16 is secured to the shaft 14 (by screws 44 or any other suitable means) and can move (on rotation of the shaft) between a fully open position, in which the flap valve forms virtually no restriction on the flow of air/fuel through the bore 38, and a substantially closed position in which the flap valve substantially closes the bore for idle operation of the engine.

The throttle body 12 has two pairs of apertures 46,48 passing therethrough, and the manifold 22 and air horn 24 have corresponding pairs of apertures 50,52 and 54,56 respectively. The apertures 50,52 in the manifold 22 are internally threaded and securing means, for example, bolts 58 (Figure 5), can extend through the apertures 46,48,54,56 in the throttle body 12 and the air horn 24 respectively and thread into the apertures 50,52 in the manifold to secure the manifold, throttle body and air horn together, to thereby secure the assembly of throttle body and air horn to the engine. The pairs of apertures 46,48 are symmetrically arranged on either side of a plane P which is aligned with the longitudinal axis Y of the shaft 14 and the longitudinal axis X of the bore 38. The distance A between each aperture of each pair of apertures 46,48 is greater than the distance B between the pairs of apertures themselves. This arrangement is such that the throttle body 12 can be rotated through 180° from the position shown in Figure 1 either about longitudinal axis X or about longitudinal axis Y and still be secured to the engine, thereby easily providing a number of variations in the positions of the throttle linkage 20, throttle position sensor 26, idle air control valve assembly 28, and fluid heating means 34 relative to the engine. This arrangement can be modified by making distances A and B the same, that is, the apertures 46,48 are equidistantly spaced apart, in which case the throttle body 12 can be rotated through 90° about longitudinal axis X to further increase the number of variations of relative positioning.

Alternatives to the above arrangement include having a single aperture on each side of plane P, with the apertures being diametrically opposed relative to the longitudinal axis X of the bore 38. Further the securing means could simply connect the throttle body 12 to the manifold 22, with a separate securing arrangement (for example, spring clips or bolts) securing the air horn 24 to the throttle body. Further still, the securing means could comprise bolts which each extend through the apertures in the air horn 24, throttle body 12, and manifold 22 and make a threaded connection with a nut or a threaded aperture in the engine.

On securing the air horn 24 to the throttle body 12, a seal (not shown) is preferably positioned between these two parts with the seal being positioned in a circumferentially extending groove in the end face 90 of the air horn.

The throttle body 12 also has a closed bore 60 formed therein which opens through the outer wall 40 and which preferably extends substantially parallel to the shaft 14; and first and second idle air bores 62,64 which are spaced apart, extend through the throttle body substantially parallel to the bore 38, and open into the closed bore. The idle air control valve assembly 28 comprises an idle air control valve seat 66 which is formed separately and positioned in the closed bore 60 between the openings to the first and second idle air bores 62,64; an idle air control valve 68 which is movable towards and away from the idle air control valve seat; and an electric motor 70 which is attached to and moves the idle air control valve, and which is positioned at the opening to the closed bore. The electric motor 70 is secured to the outer wall 40 of the throttle body 12 by a bracket 72 which substantially surrounds the end of the electric motor remote from the idle air control valve 68, and which is fastened to the outer wall by screws 74. An elastomeric seal 76 is positioned between a shoulder on the electric motor 70 and the outer wall 40 at the opening to the closed bore 60 to provide a seal between the closed bore and the electric motor. Also, a compliant cushion (not shown) may be placed between the bracket 72 and the electric motor 70 to reduce vibrations to the electric motor. In use, one end of the first idle air bore 62 aligns with and opens into one of two substantially identical openings 78,80 in the air horn 24, dependent on the position of the throttle body 12 relative to the engine. The air horn 24 has a bore 82 therethrough which aligns with the bore 38 in the throttle body 12 when the throttle body and air horn are secured together. One of the openings 78,80 provides an air passage from the bore 82 through the air horn 24 to the first idle air bore 62. The other of the openings 78,80 is closed by a portion 91 of the face of the throttle body 12 when the air horn 24 is secured thereto. The other end of the first idle air bore 62 is closed by the end face 84 of the manifold 22 when the throttle body 12 is secured to the manifold. Also, in use, one end of the second idle air bore 64 aligns with and opens into a corresponding opening 86 in the manifold 22. The manifold 22 has a bore 88 therethrough which aligns with the bore 38 in the throttle body 12 when the throttle body and manifold are secured together. The opening 86 provides an air

passage from the second idle air bore 64 to the bore 88 in the manifold 22. The other end of the second idle air bore 64 is closed by the end face 90 of the air horn 24 when the throttle body 12 is secured to the air horn. This arrangement provides an idle air passage for the flow of air from the bore 82 in the air horn 24 to the bore 88 in the manifold 22 (by way of idle air bores 62,64 and closed bore 60) irrespective of the position of the flap valve 16. The position (two positions are shown in Figure 1, one of them in dashed outline) of the idle air control valve 68 relative to the idle air control valve seat 66, which is controlled by the electric motor 70, controls the flow of air through the idle air passage. This arrangement allows easy formation of the idle air passage without the need for subsequent plugging of bores in the throttle body. Although the idle air control valve seat is shown as being formed separately from the throttle body, it could be formed integrally with the throttle body.

The throttle position sensor 26 is secured to the outer wall 40 by screws 94 which pass through apertures in the housing 92 of the sensor, and which are positioned diametrically opposed relative to the longitudinal axis Y of the shaft 14. With this arrangement, the throttle position sensor 26 can be secured to the throttle body 12 in one of two positions, one as shown in Figure 4, the other position being 180° therefrom.

The fluid heating means 34 comprises a recess 96 formed in the outer wall 40 of the throttle body 12 which is covered by a plate member 98 secured, as described in more detail below, to the outer wall. An elastomeric seal 100 is positioned between the plate member 98 and the outer wall 40 around the recess 96 to substantially prevent egress of fluid. An inlet pipe 102 and an outlet pipe 104 (the connections to which could be reversed) extend through the plate member 98 to allow fluid to flow through the inlet pipe into the recess 96 and out through the outlet pipe. This arrangement allows fluid (usually from the engine cooling system) to heat the throttle body 12 to prevent the flap valve 16 sticking in extreme cold conditions due to ice formation. The plate member 98, inlet pipe 102 and outlet pipe 104 are preferably integrally formed in one piece. The arrangement for securing the plate member 98 to the outer wall 40 comprises a number of indentations 106 formed in the peripheral edge 108 of the plate member 98 and a pair of screws 110. The screws 110 have a threaded shank 112 which screw threads into corresponding threaded bores 114 in the outer wall 40 of the throttle body 12, and a head 116. The shape of the indentations 106 corresponds to the shape of a portion of the head 116 of each screw 110 to locate the screw head in the indentation to thereby determine the orientation of the plate member 98 relative to the throttle body 12, and hence determine the positioning of the inlet and outlet pipes 102,104 relative to the throttle body. With this arrangement, the orientation of the fluid heating means 34 relative to the throttle body 12 can easily be adjusted. The arrangement shown in Figure 5 shows four indentations 106 in the plate member 98. However it will be appreciated that any number of indentations could be used. The indentations 106 are preferably equidistantly spaced around the peripheral edge 108 of the plate member 98. Although two screws 110 are shown, it will be appreciated that one of these screws could be replaced by a lip formed in the outer wall 40 under which the peripheral edge 108 of the plate member 98 can be slid to retain the plate member, the sole remaining screw then completing the mounting of the plate member. As a further alternative, the indentations may be omitted, with the screw heads acting directly on any point around the peripheral edge 108 of the plate member 98.

The throttle linkage 20 and lever arm 18 as shown are commonly referred to as a four-bar link, although other forms of throttle linkage could be used. The throttle linkage 20 comprises first and second arms 118,120 (Figure 6). The first arm 118 is pivotally connected at one end to one end 122 of the lever arm 18. The second arm 120 is substantially L-shaped (although other shapes may be used) and is pivotally connected at one end 124 to the outer wall 40 of the throttle body 12, has a connection stub 126 at the other end to which a throttle cable (not shown) can be attached, and is pivotally connected between its ends, at the elbow 128 of the L-shape, to the other end of the first arm 118. The pivotal connection of the one end 124 of the second arm 120 to the outer wall 40 is at one of two positions on the outer wall, each of which is defined by a boss 130,132. The bosses 130,132 are formed in the outer wall 40 at positions which are diametrically opposed about the longitudinal axis Y of the shaft 14. Each boss 130,132 has a threaded bore 134,136 formed therein which receives a threaded screw 138,140. The threaded bores 134,136 are substantially identical. One of the screws 138 passes through an aperture in the one end 124 of the second arm 120 to provide the pivotal connection of the throttle linkage 20 to the throttle body 12. It will be appreciated that the positioning of the throttle linkage 20 relative to the throttle body 12 can easily be reversed to the arrangement shown in Figure 7 simply by screwing the screw 138 into the threaded bore 136 in boss 132, rather than into the threaded bore 134 in boss 130, thereby allowing the direction of the throttle cable to be reversed. As an alternative to the use of threaded screws 138,140, one of the bosses may have a rod extending therefrom, and the throt-

tle linkage 20 may be pivotally secured in place on the rod by a detachable circlip or other suitable fastening means. In this case, the rod may be attached to the required boss by screw threading into one of the threaded bores 134,136.

A coil spring 142 acts on the lever arm 18, and a coil spring 144 acts on the second arm 120 to bias the flap valve 16 towards its substantially closed (idle) position as is well known in the art. The lever arm 18 may have a stop member (not shown) formed thereon adjacent the one end 122 of the lever arm which projects towards the throttle body 12 and which is engageable with the boss 132 (Figure 6, or boss 138 in Figure 7) to prevent the flap valve 16 passing beyond its fully open position.

The screw 140 forms part of the idle adjust means 30 of the throttle mechanism 10, along with a cam 146. The cam 146 has a substantially circular (cylindrical) outer surface 148 and the screw 140 passes through an off-centre aperture 150 in the cam to be screwed into the threaded bore 136 in boss 132 (Figure 6) or the threaded bore 134 in boss 130 (Figure 7). The other end 152 of the lever arm 18 is biased (by the coil springs 142,144) into engagement with the surface 148 of the cam 146 to set the substantially closed (idle) position of the flap valve 16. This position can be adjusted simply by slightly unthreading the screw 140, rotating the cam 146 relative to the screw, and then re-tightening the screw. The cam 146 is substantially cup-shaped, and the head 154 of the screw 140 is positioned inside the cup with a Belleville spring 156 or similar acting between the head and the cam. This design of idle adjust means 30 can be made tamperproof by placing a plug inside the cup to prevent access to the screw head 154. As an alternative to this arrangement, the cam may have an oval shaped outer surface. The above described arrangement makes use of features already form on the outer wall 40 of the throttle body 12, without resorting to having to add special boss(es) to receive the idle adjust means 30 or resorting to additional machining operations.

The various features of the throttle mechanism described above allow the positioning of the various elements relative to the engine to be easily adjusted, thereby allowing greater flexibility in the use of a single throttle mechanism. The two part arrangement of the throttle body and air horn allow material variations. For example, the air horn may be formed from plastics material, with the throttle body formed from cast aluminium. In this case, the seal between the air horn and the throttle body may be integrally formed with the air horn.

Reference is made to our related patent applications, nos. ____________; ____________; and ____________, filed the same day as the present application, having the reference nos. MJD/558; MJD/560; and MJD/562 respectively, and claiming priority from GB patent application nos. 9311880.0; 9311882.6; and 9311883.4 respectively.

Claims

1. A throttle mechanism (10) for an engine of a motor vehicle comprising a throttle body (12) having an inner wall (36) defining a bore (38) extending therethrough and an outer wall (40), the bore having a longitudinal axis (X); a shaft (14) extending across the bore and having a longitudinal axis (Y) substantially perpendicular to the longitudinal axis of the bore, the shaft being rotatably mounted in the inner wall of the throttle body for pivotal movement about the longitudinal axis of the shaft, at least one end (42) of the shaft passing through the inner wall to extend beyond the outer wall; a flap valve (16) secured to the shaft inside the bore for movement between a fully open position and a substantially closed position on rotation of the shaft; a lever arm (18) secured to the said at least one end of the shaft adjacent the outer wall; means (20) connected to the outer wall of the throttle body for rotating the shaft; and idle adjust means (30); characterised in that the idle adjust means comprises a cam (146) having an aperture (150) therethrough through which a threaded shank of a screw (140) can freely pass to adjustably secure the cam to the outer wall, the cam having a surface (148) which is engaged by the lever arm at a position spaced from the said at least one end of the shaft, the rotational position of the cam relative to the screw determining the closed position of the flap valve.

2. A throttle mechanism as claimed in Claim 1, wherein the surface (148) of the cam (146) is substantially circular, and the aperture (150) through the cam is offset from the centre of the circular surface.

3. A throttle mechanism as claimed in Claim 1, wherein the surface of the cam is substantially oval.

4. A throttle mechanism as claimed in any one of Claims 1 to 3, wherein the cam (146) is substantially cup-shaped and the screw (140) has a head (154) positioned inside the cup.

5. A throttle mechanism as claimed in any one of Claims 1 to 4, wherein the screw (140) resiliently engages the cam (146) by way of a Belleville spring (156).

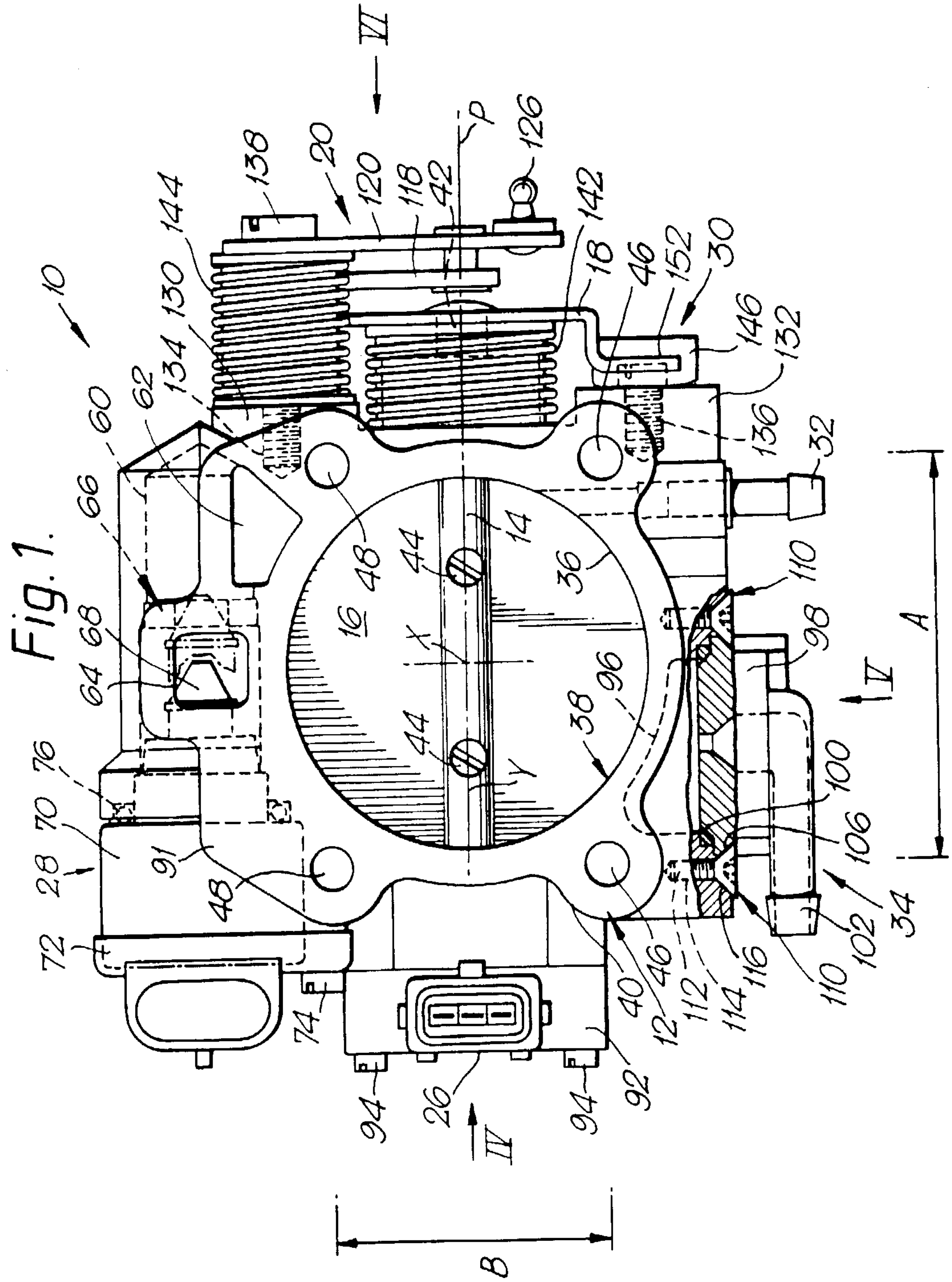

Fig.1.

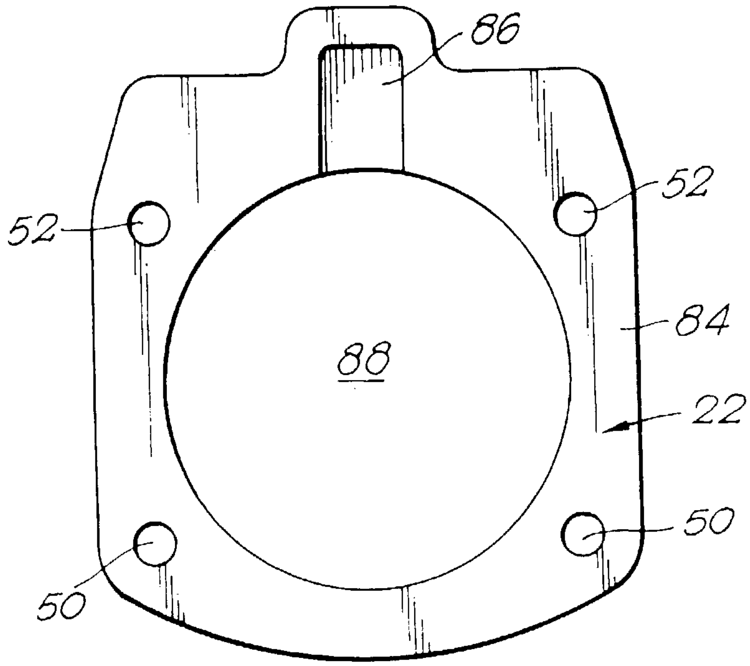

Fig. 2.

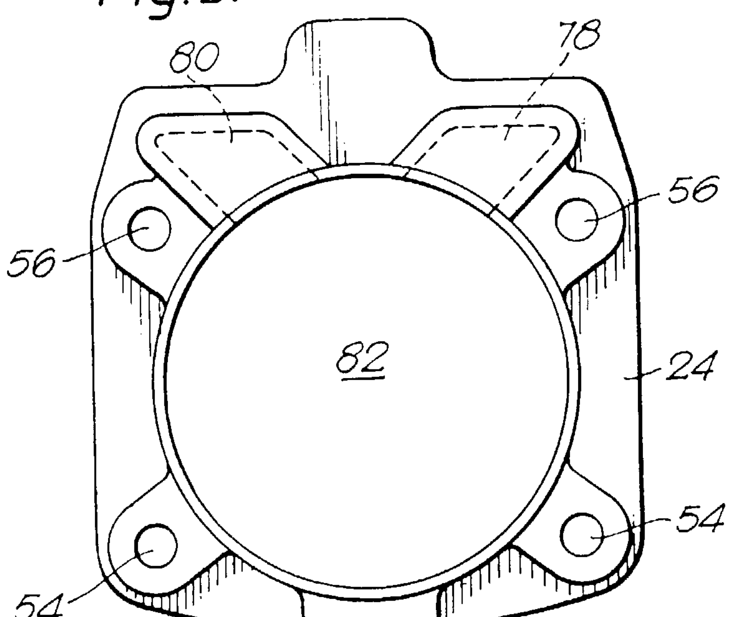

Fig. 3.

Fig. 4.

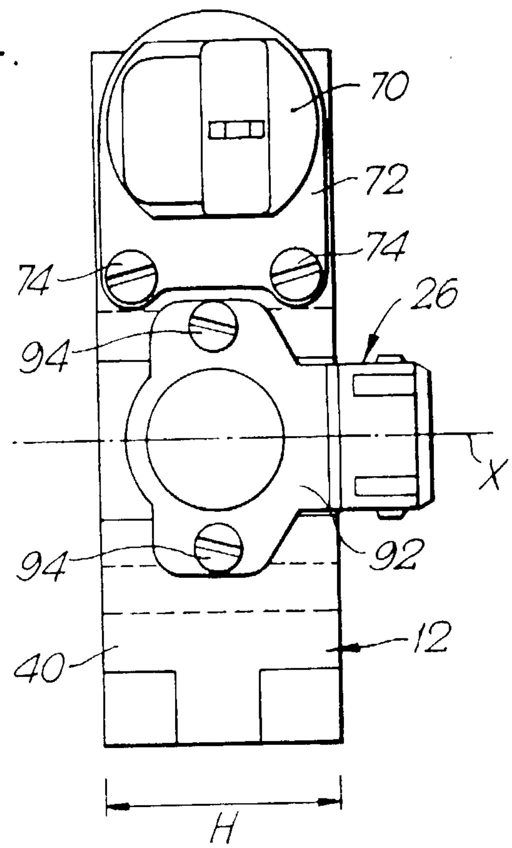
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Fig. 5.

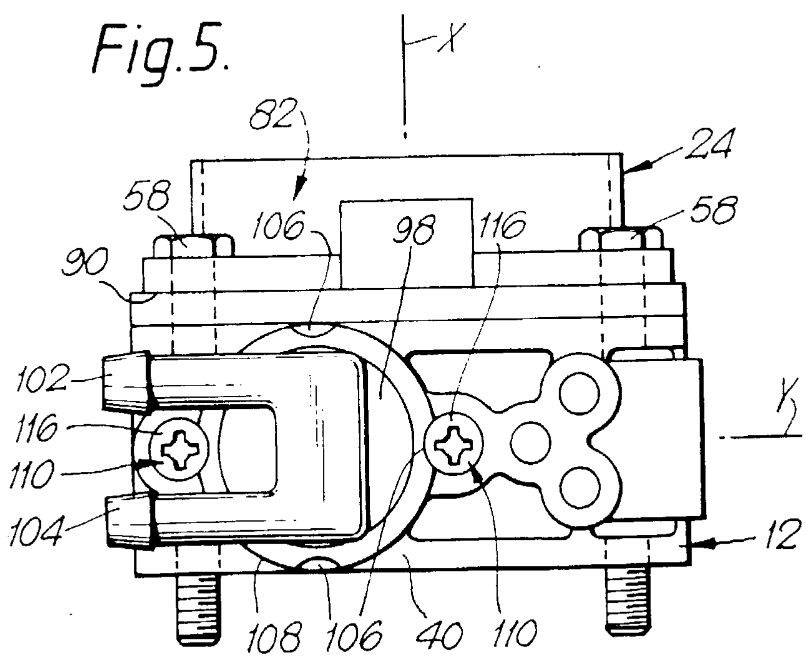
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Fig.6.

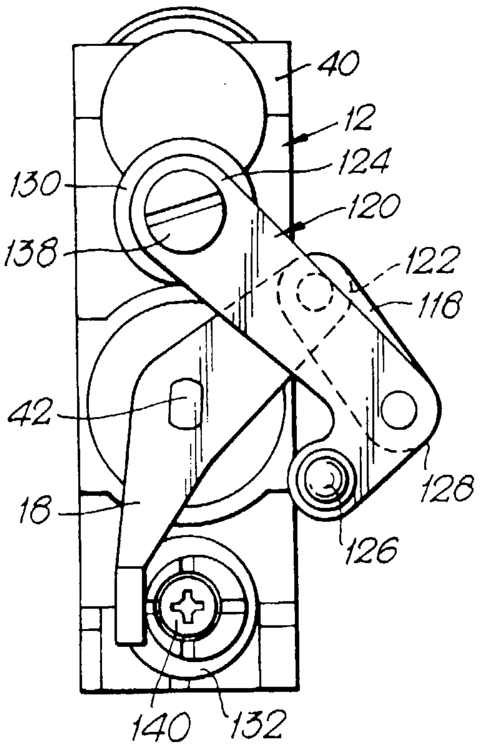


Fig.7.

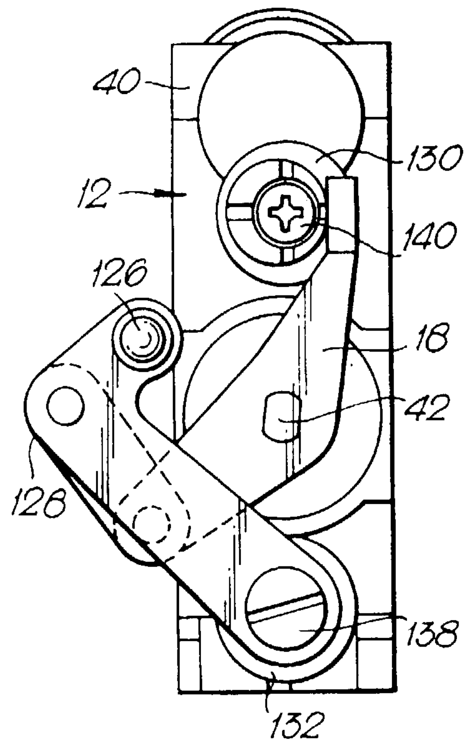
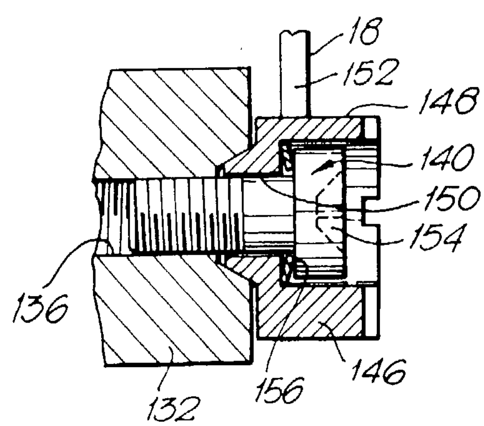


Fig.8.



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 20 1459

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	US-A-4 945 874 (NISHITANI) * column 9, line 1 - line 49; figures 11,12 * * column 11, line 10 - line 32; figure 23 * ---	1,2	F02D9/10 F02M3/06
A	US-A-4 902 448 (PHILLIPS) * column 2, line 24 - column 3, line 14; figures 1-3 * ---	1	
A	US-A-4 476 068 (GRIFFIN) -----		

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

F02D
F02M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 August 1994	Van Zoest, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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